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A Categorial Treatment of Bare-NP Adverbs[1]

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A select set of English nouns can head bare-NP adverbs – NPs that can act as adverbs without being preceded by a preposition. These 'BNPA nouns' also can be modified by prepositionless adverbial non-*wh* relative clauses. An analysis is presented in a categorial grammar framework, employing a conjunctive type structure to describe the behavior of BNPA nouns. It is suggested that non-*wh* relative clauses are selected by BNPA nouns (and ordinary nouns as well) as complements; lexical rules are written to allow such selection. Finally, some remaining issues are surveyed.

0 Introduction

Bare-NP adverbs are discussed in Larson (1983, 1985), and are NPs that can act as locative, temporal, or manner adverbs without any kind of morphological marking, as in the following examples:

(1) a. We visited Mary *last Thursday/one day/this week/that year.*
b. I lived *every place that I could afford.*
c. Tom worked the problem *every possible way.*

In short, these phrases have the internal structure of a regular NP, but the external syntax of VP modifiers. Bare-NP adverbs also include lexical items like *today, yesterday, tomorrow,* and *then* for the temporal cases, and *there, here* for locative adverbs. However, the bare-NP adverbs that interest us here are the phrasal ones, as in (1). Larson

[1] Thanks to David Dowty for guidance during early drafts of this paper, and to him, Bob Kasper, Martin Jansche, Carl Pollard, and Nathan Vaillette for useful comments and suggestions during later revisions. Any errors that remain are mine alone.

also notes that nouns that can head bare-NP adverbs are a very restricted set. For example, although most nouns denoting periods or instances of time can head a temporal bare-NP adverb, not all of them can, as seen in (2a). For bare-NP adverbs of location or manner, only the specific words *place* and *way* are eligible, as seen in (2b,c).

(2) a. *We visited Mary *that occasion/that period.*
b. *I lived *every location/home that I could afford.*
c. *Tom worked the problem *every possible method.*

For this reason, Larson favors an explanation in which eligibility to form bare-NP adverbs is part of these particular nouns' lexical entries.

Larson discusses a second property that this set of words possesses: they "can head non-*wh* adverbial relatives without preposition stranding." (Larson (1985), p. 616) Examples are shown in (3):

(3) a. the {day, *occasion} (that) the music died
b. the {place, *town} (that) I grew up
c. every {way, *method} (that) Tom worked the problem

This second property is not exclusive to this set of words; it is possible for a word to be modifiable relative clause like those seen in (3), but not be usable as a BNPA, as shown in (4). The main example, noted by Larson (1983), is *reason*, though *spot* is another example, and there may be others.

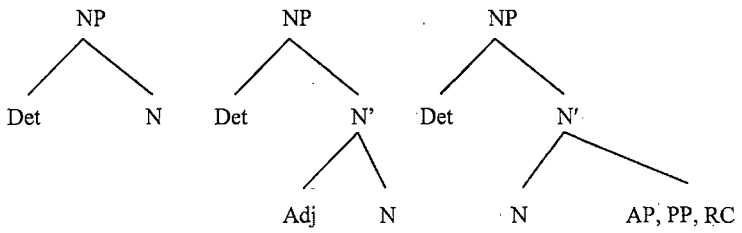
(4) a. the {reason, *cause) (that) Kim fired Robin
b. Kim fired Robin *(for) this reason.
c. a shady (spot, place, *area) to sit
d. Kim sat *(in) that spot.

The question to be investigated here is how to formally characterize this select set of words, which I will call bare-NP adverb (BNPA) nouns, and allow for BNPA-like behavior in adverbial relative clauses for non-BNPA words, such as *reason.*

Whatever property it is that BNPA nouns possess, the basic problem is that this property needs to be specified at the lexical level, but come into play only at the NP level. On the way from N to NP, though, a BNPA noun might combine with a determiner, or

some kind of modifier: prenominal adjective, postnominal adjective phrase, prepositional phrase, or relative clause, as diagrammed in (5).

(5)



The question is how to allow the crucial information associated with the BNPA noun to percolate up to the NP, past any Det or modifier. In section 1, I review some previous analyses of BNPA nouns. Section 2 develops this paper's basic approach to BNPA nouns, covering the case of the leftmost tree in (5), where a BNPA noun combines with a Det and no modifiers. Section 3 deals with the middle tree in (5) and most cases of the rightmost one, proposing means to allow for prenominal and postnominal modification of BNPA nouns. Section 4 focuses on a subset of cases with postnominal modification, specifically, non-*wh* relative clauses. Sections 5 and 6 discuss some unresolved issues and offer some concluding thoughts.

1 Previous work[2]

1.1 Larson (1983-87)

Larson proposes that the selected words that can head BNPAs assign a case to themselves, instead of having it assigned to them by a verb or preposition. Specifically, (according to the most recent version of his explanation) they optionally self-assign a general "Oblique" case, which can then be further specified as +TEMP(oral), +LOC(ation), +DIR(ection)or +MAN(ner), depending on the context (Larson (1985, 1987)). With case thus assigned, a BNPA is allowed to take its place in a sentence. Furthermore, with case assigned, BNPA words can participate in adverbial relative clauses in the same way that ordinary words with, say, an +ACC case-marking can participate in an object-modifying relative clause (as in *a book to read*). The optionality of this case-marking keeps open the possibility of using BNPA words in non-adverbial relative clauses, as in *the place we visited.* Though this system covers the linguistic facts that Larson brings up, it is

[2] The summaries of the following analyses are taken from Whitman (1998).

somewhat informal, with the context that differentiates between the different varieties of Oblique case not formally spelled out.

An earlier proposal in Larson (1983) has BNPAs subordinate to prepositionless PP nodes, a strategy that deserves further comment. Although putting a node of one syntactic category underneath another one of a different category (as Larson does by putting the adverbial NP under a PP node) is not done very much anymore, there is still an intuitive appeal to positing something like an "understood" preposition in front of a bare-NP adverb, or at the end of a non-*wh* relative adverbial clause. However, taking such a tack would not really save any work. To mention the lesser problem first, there is first the issue of what null preposition should be posited. *In* or *on* would be appropriate for locative adverbials, but not always for temporal adverbials. Even if we hypothesize some kind of general spatiotemporal preposition that does not correspond to any one preposition in the lexicon, the issue gets murkier when manner adverbials are considered. Manner adverbs seem quite different semantically from spatiotemporal ones; whereas adverbs of location and time can be seen as referring to actual areas of the space-time continuum, manner adverbs cannot. Let us assume, though, that there is such a null, spatiotemporal/manner preposition. The larger problem is that this null preposition has to be linked to the BNPA noun somehow. If it is not, then any noun will work, not just the special set of lexically marked ones that we are interested in, and ungrammatical phrases like **we stayed every location* and **every hotel that we stayed* would be licensed. So even with a null preposition, some of the work will have to be done by the individual lexical items, and therefore we might as well see if they can be made to do all of the work.

1.2 Kasper (1998)

Kasper (1998) also addresses bare-NP adverbs, in the larger context of how, in general, to modify words and phrases that have a uniform "internal semantics" but a "combinatory semantics" that varies according to their syntactic placement. One of the claimed advantages of Kasper's system is the ability to represent in a single definition words that may (despite having the same basic meaning) behave quite differently depending on syntactic usage. The prime example of such words is attributive vs. predicative adjectives. Kasper then shows how his approach could be applied to other modifiers, including adverbs and (the relevant part for our purposes) BNPA words, which, like attributive and predicative adjectives, have basically the same core meaning wherever they appear, but have radically different combinatorial semantics depending on how they are used. For instance, *place* always has the same basic meaning of "place," even though it functions as a direct object in *Search the place* and as an adverb in *live someplace.* The

basic, constant meaning is what Kasper (working within the HPSG framework) calls a sign's ICONT (mnemonic for *internal content*), while the ECONT (*external content*) carries the more specific meaning contribution that will depend on how the sign is used.

Kasper's characterization of BNPA nouns works well for the cases that he considers, i.e., those corresponding to the first two trees in (5). He does not, however, consider modification of BNPA nouns by adverbial relative clauses, such as those seen in (3). In this paper, I will explore how the BNPA facts that Larson and Kasper have written about might be described in a type-logical framework. Although this analysis will cover more ground than Kasper's, in that non-*wh* relative adverbial clauses will be considered, the basic proposals concerning them can be easily transported into the HPSG framework to form an extension to Kasper's analysis[3].

2 Encoding basic BNPA behavior

As stated in the introduction, the question is how to endow BNPA nouns with their special property at the lexical level and allow it to percolate up to the NP level. One way might be to assign a BNPA noun some feature value, which will then be inherited by its projections. Although this is not the strategy that will be taken here, a brief exploration of why it is less than optimal will help motivate the approach that will be taken.

Simple feature-passing can be handled in CG by means of what are known as dependent types, a kind of shorthand representation of categories that must share feature specification(s) with their arguments. An example of a dependent type is $\Lambda n(\mathrm{NP}(n)/\mathrm{N}(n))$, for the determiner *the* (taken from Morrill (1994), p.173). The variable n is mnemonic for number; the way this type assignment works is that the n feature can be instantiated as singular or plural, and the number value for the NP must be that of the N. The rule that allows this instantiation is the ΛE rule:

[3] Actually, Whitman (1998) attempts to extend Kasper's treatment to cover these cases, but his proposal has a problem. Specifically, although it allows a BNPA noun to be used adverbially in a main clause, or as the head of a non-*wh* adverbial relative clause without preposition stranding, it does not allow both usages at once. For instance, *We had fun every place* would be licensed, as would the phrase *every place that we stayed,* but the sentence *We had fun every place that we stayed* would not.

(6) (from Morrill (1994), p. 172)

$$\begin{array}{l} \vdots \\ \vdots \\ \Lambda vA \\ \hline A[v \leftarrow t] \end{array} \Lambda E$$

This says that ΛvA can be realized as something of category A, with any *v*'s replaced by the value *t*. Thus, *the*: Λn(NP(*n*)/N(*n*)) could be instantiated as *the*: (NP(sg)/N(sg)) or as *the*: (NP(pl)/N(pl)). Where this becomes important is when *the* combines with a noun. If the noun is a plural one, for example, *dogs*: N(pl), then it can combine only with the (NP(pl)/N(pl)) version of *the*, to yield *the dogs*: NP(pl).

Suppose, then, that we call the feature that indicates whether a noun can become a bare-NP adverb head *adv*, with ordinary nouns having a (-) value for this feature, and BNPA nouns having (+). To allow nouns to pass this feature value up to the NP level, determiners would be specified thus: Λadv(NP(*adv*)/N(*adv*)). Attributive adjectives would be of category Λadv(N(*adv*)/N(*adv*)); relative clauses of category Λadv(N(*adv*)\N(*adv*)).

Now consider the VP *stay every place*. The NP *every place* will be of type NP(*adv* +), but I have not said how an NP's having a (+) value for its *adv* feature actually translates into its behaving as an adverb. To combine with *stay*, the NP *every place* needs to be of type VP\VP; it is not sufficient to be of type NP(*adv* +). In order for an analysis using dependent types to work, then, I will need to have a rule like the following:

(7) $$\frac{\text{NP}(adv +)}{\text{VP}\backslash\text{VP}}$$

The same effect can be achieved, however, without having to stipulate an extra rule of inference like that in (7), by using the already defined logical inference rules for types with Boolean conjunction. It is these that will form the basis for my analysis. As presented in Morrill (1994), a conjunctive type is of form A $\wedge$ B, with the following interpretation and rules of introduction and elimination:

(8) (from Morrill (1994), p. 162)
$D(A \wedge B) = \{\langle s, \langle m1, m2\rangle\rangle \mid \langle s, m1\rangle \in D(A) \wedge \langle s, m2\rangle \in D(B)\}$,
where *s* is a prosodic form, and *m1* and *m2* are semantic terms.

(9) (from Morrill (1994), p. 163)

$$\frac{A \wedge B}{A}\wedge E a \qquad \frac{A \wedge B}{B}\wedge E b \qquad \frac{\begin{array}{cc}\overset{n}{\Gamma} & \Gamma \\ A & B\end{array}}{A \wedge B}\wedge I n$$

The rule in (8) states that any element of category A∧B will be a string *s*, which has an ordered pair of meanings, *m1* and *m2*, such that *m1* is in the domain for type A, and *m2* is in the domain for the type B. Another way to read this is that elements of type A ∧ B are in the intersection of the set of elements of type A, and elements of type B. The rules of elimination (∧E*a* and ∧E*b*) in (9) state that given an element of category A ∧ B, it can be considered an A or a B. The rule of introduction states that if the categories A and B can each be derived from the same sequence Γ, then Γ can be given category A ∧ B. Morrill uses such a type assignment for prepositions, giving them the type ((N\N) ∧ (VP\VP))/NP, indicating that after they take an NP argument, they can be both nominal modifiers (N\N), and adverbs (VP\VP).

A simple conjunctive type assignment would work well for the single-word bare-NP adverbs, such as *yesterday* or *here*, which could be assigned the category NP ∧ (VP\VP). For BNPA nouns, however, which form bare-NP adverbial phrases after combining with a determiner, the category assignment would be N ∧ Det\(VP\VP) – in other words, something that is a common noun (N), and also can combine with a determiner (Det) to form a verbal modifier (VP\VP).

The category for the specific BNPA noun *place*, then, will be N ∧ Det\(VP\VP), and the term will be an ordered pair. The first element of the ordered pair will correspond to the N category: **place'**. The second element will correspond to the Det\(VP\VP) category, with the meaning $\lambda\mathcal{D}\lambda Q\lambda y.\mathbf{in'}(\mathcal{D}(\mathbf{place'}))Q(y)$[4]. For illustration, the derivation of *We stayed every place* is shown below:

[4] Issues of quantifier scope will not be considered here.

(10)

we	*stayed*	*every*	*place*
NP:	VP:	NP/N:	N ∧ Det\(VP\VP):
we'	**stay'**	$\lambda P.\mathbf{every}(P)$	$< \mathbf{place'},$
			$\lambda \mathcal{D}\lambda Q\lambda y.\mathbf{in'}(\mathcal{D}(\mathbf{place'}))Q(y) >$
			——————————— ∧E
			Det\(VP\VP):
			$\lambda \mathcal{D}\lambda Q\lambda y.\mathbf{in'}(\mathcal{D}(\mathbf{place'}))Q(y)$
		——————————— \E	
		VP\VP: $\lambda Q\lambda y.\mathbf{in'}(\mathbf{every})(\mathbf{place'})Q(y)$	
——————————— \E			
VP = NP\S: $\lambda y.\mathbf{in'}(\mathbf{every})(\mathbf{place'})\mathbf{stay'}(y)$			
——————————— \E			
S: $\mathbf{in'}(\mathbf{every})(\mathbf{place'})\mathbf{stay'}(\mathbf{we'})$			

Notice that the category for the phrase *every place* in the above derivation is not the same as for a lexical BNPA. A lexical BNPA like *here* is of category NP ∧ (VP\VP), with two meaning packed into an ordered-pair semantic term, but in (10), the phrase *every place* is associated with only a single semantic term (i.e., the adverbial one). Of course, *every place* is ambiguous, between an NP and a VP\VP reading, but the ambiguity will turn up as two separate parses, not as a single parse with an ordered-pair semantic term for the phrase. The choice as to whether *place* will ultimately be part of an NP or a VP\VP has to be made at the ∧E step. For the sake of parallelism, it might be argued that *place* should be assigned the category Det\(NP ∧ (VP\VP)), so that after it combines with a determiner, it will have category NP ∧ (VP\VP), like a one-word BNPA. However, such a move causes trouble when modification of BNPA nouns is considered (as will be seen in the next section), and therefore N ∧ (Det\(VP\VP)) will remain as the chosen categorization for BNPA nouns.

3 Modification of BNPA nouns

3.1 The problem

My category assignment for BNPA nouns in their adverbal incarnation is Det\(VP\VP), which I will abbreviate as N-*bnpa*. Prenominal adjectives, of category N/N, will also need to be of category N-*bnpa*/N-*bnpa*, if they are ever to modify a BNPA noun that is used adverbially. Likewise, a postnominal modifier (for example, a prepositional phrase, or a longer adjective phrase, or a relative clause), usually of category N\N, will also have to belong to category N-*bnpa*\N-*bnpa*. This can be achieved in short order by simply

giving appropriate additional type assignments to adjective, prepositions, etc., but in the case of prenominal modifiers, it turns out that no additional type assignments are necessary, since N-*bnpa*/N-*bnpa* is derivable from N/N, as shown in (11):

(11)
$$\frac{\dfrac{\dfrac{\dfrac{[(NP)/N]^{2} \qquad \dfrac{N/N \qquad [N]^{1}}{N}/E}{NP}/E}{(NP)/N = Det}/I1 \qquad [Det\backslash(VP\backslash VP)]^{3}}{VP\backslash VP}\backslash E}{(Det)\backslash(VP\backslash VP) = \text{N-}bnpa}\backslash I2$$
$$\text{N-}bnpa/\text{N-}bnpa \quad /I3$$

A derivation of a BNPA phrase with an adjective given this category is shown in (12), where $\mathcal{B}$ is a metavariable for elements of type N $\wedge$ N-*bnpa*:

(12)
$$\frac{\dfrac{\textit{every} \qquad \textit{available} \qquad \textit{place}}{\dfrac{\text{Det/N:} \quad \text{N-}bnpa/\text{N-}bnpa: \quad \text{N} \wedge \text{N-}bnpa:}{\dfrac{\lambda P.\mathbf{every}(P) \quad \lambda\mathcal{B}\lambda\mathcal{D}.\mathcal{B}(\lambda P(\mathcal{D}(\mathbf{available'}(P)))) \quad \dfrac{<\mathbf{place'}, \lambda\mathcal{D}''\lambda Q\lambda y[\mathbf{in'}(\mathcal{D}''(\mathbf{place'}))Q(y)]>}{\text{N-}bnpa: \lambda\mathcal{D}''\lambda Q\lambda y[\mathbf{in'}(\mathcal{D}''(\mathbf{place'}))Q(y)]}\wedge E}{\text{N-}bnpa = \text{Det}\backslash(\text{VP}\backslash\text{VP}):}\backslash E}$$

$\lambda\mathcal{B}\lambda\mathcal{D}(\mathcal{B}(\lambda P(\mathcal{D}(\mathbf{available'}(P))))(\lambda\mathcal{D}''\lambda Q\lambda[\mathbf{in'}(\mathcal{D}'')(\mathbf{place'})Q(y)])$

$\Leftrightarrow \quad \lambda\mathcal{D}(\lambda\mathcal{D}''\lambda Q\lambda y[\mathbf{in'}(\mathcal{D}''(\mathbf{place'}))Q(y)])(\lambda P(\mathcal{D}(\mathbf{available'}(P))))$

$\Leftrightarrow \quad \lambda\mathcal{D}\lambda Q\lambda y[\mathbf{in'}(\lambda P(\mathcal{D}(\mathbf{available'}(P)))(\mathbf{place'}))Q(y)]$

$\Leftrightarrow \quad \lambda\mathcal{D}\lambda Q\lambda y[\mathbf{in'}(\mathcal{D}(\mathbf{available'}(\mathbf{place'})))Q(y)]$

$$\frac{\text{VP}\backslash\text{VP}: \lambda Q\lambda y[\mathbf{in'}(\mathbf{every}(\mathbf{available'}(\mathbf{place'})))Q(y)]}{}\backslash E$$

However, there are signs that the category N-*bnpa*/N-*bnpa* is not what we ultimately want for doing the job of prenominal modification. First of all, the analogous category of N-*bnpa*\N-*bnpa* for postnominal modifiers is not derivable from N\N[5] (proof given in Appendix), and would therefore have to be built into the lexical category assignments (for example, (N-*bnpa*\N-*bnpa*)/NP for prepositions). Given the close relationship between many prenominal and postnominal modifiers (in particular, the pre- and postnominal positioning of English adjectives without and with complements, respectively), a more uniform solution should be preferred.

Second, as with the derivation for *every place*, the ambiguity between the NP and VP\VP readings of this phrase will show up as two separate parses, not as a pair of semantic terms in a single parse. This state of affairs is not terribly expensive when all we are concerned with is determiners, but when adjectives enter the picture, the cost increases. If *every place* were parsed with a chart parser, there would be two edges spanning *every* and *place*, one with category NP, and the other with VP\VP. Likewise, for *available place*, there would be two edges, labeled N and N-*bnpa*. But there can be in theory any number of adjectives, and for a BNPA noun preceded by a sequence of n adjectives, there will be $2n$ edges spanning the various adjectives in the sequence and the cumulative noun category to their right. For example, for the phrase *available smoke-free place,* there would be two edges spanning *smoke-free* and *place,* and two edges spanning *available* and *smoke-free place.*

Finally, we have an extension of a problem raised by Sadler and Arnold (1994), and elaborated by Kasper (1998) in motivating his system for recursive modification. As Kasper points out, in a phrase like *apparently available,* it is unknown whether *available* is predicative or attributive. Therefore, *apparently* as an adjectival modifier will have to have two lexical specifications, one that takes a predicative adjective as an argument, and one that takes an attributive. In type-logical terms, *apparently* would have to be assigned to both Adj/Adj and (N/N)/(N/N) categories, where Adj is the atomic category given to predicative adjectives. This system becomes even more complicated in the case of a phrase like *apparently permanently available.* Here, *permanently* would have categories Adj/Adj and (N/N)/(N/N), and since *apparently* takes *permanently* as its argument, *apparently* will also have to be assigned to the categories (Adj/Adj)/(Adj/Adj) and ((N/N)/(N/N))/((N/N)/(N/N)). Since the depth of this recursive modification is theoretically unbounded, adverbs will have to be assigned to an infinite number of categories. In our case, the extension of this problem is that adjectives would now have a

[5] At least, not without having Associativity as a structural rule in our calculus.

third category, N-*bnpa*/N-*bnpa*, in addition to the other two, resulting in a corresponding multiplication of categories for adverbs that modify them. If only for the convenience of grammar writers, it would be more desirable to have some means of allowing modifiers of adjectives and adverbs to be underspecified for what kind of adjectival or adverbial arguments they take, and to pass on whatever categorial ambiguity there is.

3.2 Solution: the © variable

3.2.1 Definition

In fact, there is already one method of underspecifying a set of categories. Specifically, since Ades and Steedman (1982), $A\$$ has been used to represent any category from the set $\{A, X \rightarrow A, X \rightarrow Y \rightarrow A, \ldots\}$, that is, any category which becomes category A after all its arguments have been supplied. I propose a variable similar to the $ variable: ©. $A©$ will represent any category from the set $\{A, A \wedge B, A \wedge B \wedge C, \ldots\}$. A formal definition of this variable is given in (13):

(13) Definition of the © variable

$$A©0 = A$$

$$A©1 = \mathop{Y}_{X \in \mathcal{T}} (A \wedge X)$$

$$A©2 = \mathop{Y}_{Xi \in \mathcal{T}} (A \wedge X1 \wedge X2)$$

$$A©n = \mathop{Y}_{X \in \mathcal{T}} (A \wedge X1 \wedge \ldots \wedge Xn)$$

$$A© = \mathop{Y}_{i=0}^{\infty} A©i$$

With this variable defined, attributive adjectives can be assigned the category N©/N© instead of N/N; appropriate adjustments to lexical items such as prepositions and relative pronouns will yield the category N©\N© for (most) postnominal modifiers. If N© is instantiated as N ∧ N-*bnpa,* then attributive adjectives can modify BNPA nouns while preserving the categorial ambiguity between N and N-*bnpa.* And for the general problem of modification of attributive and predicative adjectives, since adjectives are of category Adj ∧ N©/N©, adverbs that modify them can be assigned the category Adj©/Adj©.

The semantics for adjectives of category Adj ∧ N©/N© (and adverbs of category Adj©/Adj©) remains to be spelled out. I will consider adjectives first, via the specific case of *available place.* As an N ∧ N-*bnpa*,, this phrase would have the meaning < **available'(place')**, $\lambda\mathcal{D}\ \lambda Q\lambda y$[**in'**($\mathcal{D}$ (**available'(place')**))$Q(y)$]>. The following semantic term assigned to the attributive (N©/N©) version of *available* would yield this ordered-pair semantics when applied to the term for *place*: λw< **available'**($\pi 1w$), $\pi 2w$[$\pi 1w \rightarrow$ **available'**($\pi 1w$)], ...>. In other words, the meaning **available'** is applied to the argument element that is of category N (i.e., $\pi 1w$), while all other elements (in this case, only $\pi 2w$) are unchanged except for the replacement of any instances of $\pi 1w$ with **available'**($\pi 1w$). The predicative (Adj) term would be simply **available'**. Putting together predicative and attributive terms for *available,* we get the ordered-pair term: < **available'**, λw< **available'**($\pi 1w$), $\pi 2w$[$\pi 1w \rightarrow$ **available'**($\pi 1w$)], ...>>.

Now consider the adjective phrase *apparently available.* With the term for *available* as given above, the term for *apparently available* would be: < **apparent'(available')**, λw<**apparent'(available')**($\pi 1w$), $\pi 2w$[$\pi 1w \rightarrow$ **apparent'(available')** ($\pi 1w$)], ...>>. The semantics for *apparently* would then be λv< **apparent'**($\pi 1v$), $\pi 2v$[$\pi 1v \rightarrow$ **apparent'**($\pi 1v$)], ...>; that is, the meaning **apparent'** would apply to the first term for *available* ($\pi 1v$ = **available'**), while the other terms (in this case, only $\pi 2v$) are copied over, replacing **available'** with **apparent'(available')**. The derivation of *apparently available place* in (14) illustrates the mechanics of both N©/N© and Adj©/Adj©.

(14) Derivation of *apparently available place* with © variable

PART A:

apparently	*available*
Adj©/Adj©:	Adj ∧ N©/N©:
$\lambda v <$ **apparent'**$(\pi 1 v)$,	$<$ **available'**, $\lambda w <$ **available'**$(\pi 1 w)$,
$\pi 2 v[\pi 1 v \rightarrow$ **apparent'**$(\pi 1 v)]$, ...>	$\pi 2 w[\pi 1 w \rightarrow$ **available'**$(\pi 1 w)]$, ...>>

© instantiation

(Adj ∧ N©/N©)/(Adj ∧ N©/N©):
$\lambda v <$ **apparent'**$(\pi 1 v)$,
$\pi 2 v[\pi 1 v \rightarrow$ **apparent'**$(\pi 1 v)]>$

/E

Adj ∧ N©/N©: $<$ **apparent'(available')**,
$\lambda w <$**apparent'(available')**$(\pi 1 w)$,
$\pi 2 w[\pi 1 w \rightarrow$ **apparent'(available')** $(\pi 1 w)]$, ...>>

∧E

N©/N©: $\lambda w <$ **apparent'(available')**$(\pi 1 w)$,
$\pi 2 w[\pi 1 w \rightarrow$ **apparent'(available')** $(\pi 1 w)]$, ...>

© instantiation

(N ∧ N-*bnpa*)/(N ∧ N-*bnpa*): $\lambda w <$ **apparent'(available')**$(\pi 1 w)$,
$\pi 2 w[\pi 1 w \rightarrow$ **apparent'(available')** $(\pi 1 w)] >$

PART B:

apparently available	*place*
(N ∧ N-*bnpa*)/(N ∧ N-*bnpa*):	N ∧ N-*bnpa*:
$\lambda w <$ **apparent'(available')**$(\pi 1 w)$,	$<$ **place'**, $\lambda \mathcal{D} \lambda Q \lambda y.$ **in'**
$\pi 2 w[\pi 1 w \rightarrow$ **apparent'(available')** $(\pi 1 w)] >$	$(\mathcal{D}($**place'**$))Q(y) >$

/E

N ∧ N-*bnpa*: $<$ **apparent'(available')(place')**,
$\lambda \mathcal{D} \lambda Q \lambda y.$**in'**$(\mathcal{D}($**apparent'(available')(place')**$))Q(y) >$

3.2.2 Other thoughts

The © variable, then, allows a succinct characterization of modification of BNPA nouns by adjective and prepositional phrases and (most) relative clauses, and further, provides a CG analog of Kasper's HPSG treatment of recursive modification in general. Also, it can now be seen why choosing Det\(NP ∧ VP\VP) for the category for BNPA nouns would have caused trouble when modification was considered. Under the analysis

presented here, BNPA nouns can be modified only by virtue of their N $\wedge$ N-*bnpa* categorization, which is a possible realization of N©. The category Det\(NP $\wedge$ VP\VP) does not fit this description.

However, an assumption that was made in the presentation of the © variable needs to be made explicit. Specifically, it has been assumed that in the tuple assigned to a lexical item belonging to a conjunctive category, all the elements share a core meaning, which can be written as the first element; for example, general template for an attributive adjectives (N©/N©) would have the semantics $\lambda w\langle\alpha(\pi 1 w), \pi 2 w[\pi 1 w \rightarrow \alpha(\pi 1 w)], \ldots\rangle$, which assumes that if any other categories than N are associated with the noun modified by the adjective, the corresponding terms will contain as a subterm the term associated with the N. In other words, $\pi 2w$ and $\pi 3w$ and $\pi 4w$, etc., will all contain at least one instance of $\pi 1w$, which can be replaced by $\alpha(\pi 1 w)$. Considering whether this sharing of a core meaning is generally true for conjoined types brings up the question of exactly how much meaning two words or phrases must share in order to be combined under one lexical entry.

Bayer (1996) addresses this issue. He reminds the reader that Morrill (1994) actually defines two kinds of conjunctive constructor, semantically active and semantically inactive. For the former, the component terms of the tuple need not share a core meaning; for the latter, the word's meaning must be the same, regardless of the category (and as a consequence, the conjoined categories must all have the same semantic type). Bayer's stance is that semantically inactive conjunction conforms best to the linguistic evidence; after all, if semantically active conjunction is allowed, one can write a single lexical entry for *can* as a transitive verb and a modal auxiliary, thus licensing sentences like this one from Pullum and Zwicky (1986):

(15) *I can tuna for a living and get a job if I want.

The above example notwithstanding, Morrill does have a good reason for wanting semantically active conjunction: to allow lexical entries to capture (for example) the adnominal and adverbial uses of prepositions, which have intuitively a single meaning, but must formally have two meanings. The assumption that has been made here of a shared core meaning strikes a middle ground: semantically semi-active conjunction, as it were. It will trivially cover semantically inactive conjunction, and will also allow for the cases that Morrill wanted to include.

One final point about semantically semi-active bears discussion. It may seem that I am demanding that the $\wedge$ type constructor be noncommutative, since it relies crucially on the difference between $\pi 1\alpha$ and other elements in the semantic tuple. However, this is actually not the case. The only requirement being made is that the elements CAN be written such that the core meaning appears as $\pi 1\alpha$, not that it must.

4 BNPA nouns modified by non-*wh* relative clauses

4.1 The problem

Now that the general ideas about modification of BNPAs have been covered, I turn to modification by non-*wh* relative clauses (RCs) in particular. Unlike *wh-* RCs, where the relative pronoun can be assigned a category like (N©\N©)/(S/NP)[6], in non-*wh* RCs there is no easy place to install the semantic machinery that changes a clause into a nominal modifier. Indeed, in RCs not introduced by a relative pronoun, there is no place at all! And even in RCs introduced by *that*, we would not want to treat *that* just like a *wh-*pronoun, although this is often done in simple illustrations, because of the trouble we encounter when adverbial *that* RCs are considered. For example, in a phrase like *place that we stayed*, we would need *that* to have a category like (N-*bnpa*\N©)/S, or possibly (N-*bnpa*\N©)/(S/(VP\VP)) if we consider there to be an adverbial gap. If we were to write such an entry for *that*, though, we would need to include prepositional information in the semantic term: **in'** for locative and temporal adverbials; something else for manner adverbials. In other words, we would actually have to write several more entries for *that*, thus duplicating the information supplied by individual BNPA nouns and missing the generalization that we have been trying to capture all along. In the following section, an analysis will be developed that covers non-*wh* RCs, both adverbial and nonadverbial, for BNPA nouns and ordinary nouns alike.

[6] Actually, this category as given would allow only for right-peripheral extraction. To allow for nonperipheral extraction as well, a category like (N©\N©)/(S/ΔNP), where a category tagged with Δ has access to a commutative modality. For simplicity, however, I will not show the Δ in my notations.

4.2 The solution: background and basic idea

The proposed solution requires some background discussion and motivation, which will take up sections 4.2.1 and 4.2.2, with the basic proposal laid out in 4.2.3, and the details in 4.2.4.

4.2.1 Non-*wh* relative clauses: a natural class

The first thing to note is that non-*wh* RCs, introduced by *that* or by no relativizer at all, form a natural class. First of all, unlike *wh-* relative pronouns, *that* and the null relativizer are used exclusively for restrictive RCs. Furthermore, unlike *wh-* relative adverbs (such as *where* and *when*), *that* and the null relativizer can head adverbial RCs only when it is a BNPA noun that is being modified, as was seen in (3). Given this unity, we can think of non-*wh* RCs as clauses preceded by an optional *that.* If *that* is optional, having the same semantic effect whether or not it is present, the most logical semantics to assign it is the identity function: $\lambda X.X$.

4.2.2 Relativizer *that* and complementizer *that*

There is, of course, another *that* which is optional, and which contributes no meaning to phrases that contain it: the complementizer *that*. Since complementizer and relativizer *that* have the same phonology and the same meaning, the default assumption would be that they are the same lexical item. In fact, this is not a new proposal. In a survey of a century's worth of literature on this hypothesis, Van der Auwera (1985) credits Jespersen with first expressing it, in an 1885 grammar textbook. Van der Auwera presents 24 arguments for the unity of "R(elativizer)-*that*" and "C(omplementizer)-*that*" that he has found in the literature, including those mentioned here and in 4.2.1. Van der Auwera himself, however, does not believe these arguments, and sets about refuting them. Some of the arguments that he refutes truly are weak, but others deserve comment.

I cited the optionality of R-*that* and C-*that* as a reason for merging them. This argument appears in van der Auwera's synthesis, as Argument 11: "Both R-*that* and C-*that* are deletable; if we say that they are the same, we arrive at a generalization" (p. 159). Van der Auwera argues quite logically against the argument as just stated: an RC with no relativizer could just as easily have deleted a *wh*-pronoun as a *that*; furthermore, the conditions for deleting R-*that* are completely different from the conditions for deleting C-*that.* However, in my analysis there will be no appeal to underlying structure, and hence no deletion, so this refutation loses much of its basis.

Diachronic evidence is the basis of Argument 15 in the survey: earlier in the history of English, *that* seems to have been only a complementizer (p. 162). For specifics on this line of argumentation, Allen (1977, 102-105) is recommended. Van der Auwera's response to the diachronic argument is the same as mine: accepting that complementizer *that* can introduce RCs in OE does not necessarily mean that it can still do so in Modern English. However, as corroborative evidence, it does show that unity of R-*that* and C-*that* is not such an improbable idea.

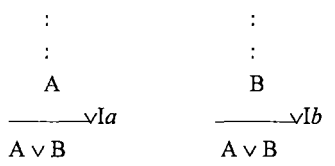
In response to the facts about *that* when it introduces adverbial RCs for BNPA nouns, Van der Auwera makes his own proposal for keeping R-*that* and C-*that* distinct, but it is rather informal, and explicitly allows non-BNPA nouns to be modified by prepositionless *that* RCs every now and then. He offers the sentences in (16) as evidence of non-BNPA nouns being modified in this way:

(16) (from van der Auwera (1985), (77), (80), (29))
a. This is the reason that/why/for which I did it.
b. I saw Fred in the street that/where/in which John lived.
c. We parted in the same cordial fashion that we had met.

Of these sentences, however, (16.b) and (16.c) are just instances of antecedent-contained deletion: the missing preposition *in* is present elsewhere in the sentence. Substitute another preposition, and the sentences are bad once again, as in **I saw Fred near the street that John lived.* Van der Auwera is correct, however, that (16.a) is a clear case of a non-BNPA noun being modified by a prepositionless adverbial *that* RC. But *reason* is the only word I know of that allows this, and on the whole it seems preferable to say something specific about *reason* (which I will do in section 4.6) than to have the massive overgeneration with all the other nouns that van der Auwera's proposal will allow.

Having identified R-*that* with C-*that*, I will adopt Morrill's (1994) treatment of C-*that* and extend it to cover R-*that*. In Morrill's analysis, complementized sentences are of category CP, and thus *that* is given category CP/S. To capture this fact, Morrill makes use of disjunctive types, the dual of the conjunctive types. The rules of introduction are presented below:

(17) (from Morrill (1994), p. 168)



A verb like *say* or *believe* would be assigned category VP/(CP ∨ S). If it is followed by a CP, for example, *that Robin is a spy*, the ∨I*b* rule can derive a CP ∨ S, which can then combine with the verb. Similarly, if the verb is followed by an S (*Robin is a spy*), the ∨I*a* rule can derive the CP ∨ S. As for the semantics, Morrill assumes that both CP and S are type-mapped into the same set of semantic objects – in other words, T(CP ∨ S) = T(CP) = T(S), where $T(A)$ is the set of semantic terms of the category A. The semantic part of the rules for disjunctive types is in general more complex than for conjunctive types, but in cases like this, when the meaning is the same for both disjuncts (or in Morrill's words, when we have semantically inactive disjunction), nothing special need be said.

Turning to RCs, nonadverbial RCs introduced by *that* would be of category CP/NP. That is, the CP/S (*that*) would combine with the S/NP (for example, *we found*) via Function Composition to yield a CP/NP (*that we found*). Those without a relativizer would simply be S/NP. As for the category for adverbial RCs, there is room for discussion. In a phrase like *place that we believe Elvis slept,* the adverbial RC *that Elvis slept* could be considered a CP, or it could be considered a CP/(VP\VP), depending on the grammar-writer's beliefs about adjunct extraction. The stance taken here will be that adverbial RCs do have an extracted adverb, and so their category will be taken to be CP/(VP\VP). (For evidence of the syntactic unity between adverbial extraction and subject and object extraction, see Hukari and Levine (1995).) The CP/S would combine with an S/(VP\VP) via Function Composition, resulting in a CP/(VP\VP). Adverbial RCs with no relativizer would have the category S/(VP\VP)

4.2.3 Non-*wh* relative clauses as complements

So far, it has been determined that non-*wh* RCs will be of category CP/NP or S/NP (for the nonadverbial RCs); or CP/(VP\VP) or S/(VP\VP) (for the adverbials RCs). In other words, the question of how to acquire the category N©\N© (or N-*bnpa*\N-*bnpa*) for non-*wh* RCs has been sidestepped: they will not have that category at all. The question now is how these RCs will be connected with the nouns they modify.

The answer is that they will be connected in the same way that the CP or S *(that) Robin is a spy* was connected to *believe* in the previous example: they will be selected as complements. For example, if *book* takes a complement of category (CP ∨ S)/NP, the meaning will be the same whether the complement is *I read* or *that I read.* Or in the case of a BNPA noun, if *place* takes a complement of category (CP ∨ S)/(VP\VP), the meaning will be the same whether the complement is *Elvis slept* or *that Elvis slept.*

There is actually some independent motivation for having non-*wh* RCs (actually, restrictive RCs in general) as complements instead of adjuncts. As McCawley (1988) notes, "One serious problem for an analysis of restrictive clauses as adjuncts to N-[bar]s is that they can appear in combination with words such as *someone, anything, nobody,* and *who* that appear to be not N-[bar]s but whole NPs" (p. 423). Alone, this problem might not be enough to show that all *that* RCs are complements instead of adjuncts, but taken in conjunction with the evidence from BNPA nouns, the case for *that* RCs as complements becomes much stronger. In the next section, I will lay out the lexical rules to accomplish this.

Before doing so, however, one obstacle to the unified analysis of non-*wh* RCs should be addressed. Specifically, I have no way of ruling out subject extraction in RCs without a relativizer, as in **There was a farmer had a dog.* I do not have an explanation for this fact. I will observe that sentences like *There was a farmer had a dog* are understood by most speakers, and are even grammatical in certain dialects (and in the occasional folksong). It may be that there are problems in processing *that*-less subject RCs, especially when they appear in contexts other than following expletive *there.* For example, *A farmer had a dog came to town* is much more difficult to get than **There was a farmer had a dog.* Bolinger (1972) writes, "... it appears that the reason why *that* as a subject cannot normally be omitted is not because it is a subject but because without it the constituents are too hard to identify," and to support this conclusion offers nonsubject RCs where omission of *that* is grammatically questionable. The most interesting examples involve sentential adverbs; when the adverb comes before the verb, omission of the *that* creates such a severe garden-path effect as to make the sentence ungrammatical, as seen in *The oranges (*generally) he ate were navels.* Therefore, I suspect that this problem is not really a big one for the analysis here. However, the worst-case scenario is that RCs introduced by *that* and RCs with no relativizer will have to be handled separately. All this means is that every lexical rule I write that involves CP ∨ S, I will have to split into two or more rules. One of them will involve CPs, while the other(s) will involve Ss, encoding somehow the constraint against subject extraction. The claim that non-*wh* RCs need to be taken as complements, though, will not be affected.

4.3 The solution: mechanics

4.3.1 Adverbial relative clauses

I will begin with BNPA nouns, positing a rule that allows them to take an adverbial non-*wh* RC as an argument. In this and other rules, **prep** stands for whatever prepositional relation appears in the BNPA noun's lexical semantics.

(18) Adverbial RC addition lexical rule for BNPA nouns
N ∧ N-*bnpa*: <π1α, π2α> ⇒
(N ∧ N-*bnpa*)/((CP ∨ S)/(VP\VP)): λ*S*<λ*x*[*S* (**prep** (*x*)) & π1α(*x*)],
π2α[π1α→ λ*x*[*S* (**prep** (*x*)) & π1α(*x*)]]>

For *place,* π1α is **place'**; π2α is λ𝒟λ*Q*λ*y*.**in'**(𝒟(**place'**))*Q*(*y*); the output lexical entry for (18) is therefore λ*S*< λ*x*[*S*(**in'**(*x*)) & **place'**(*x*)], λ𝒟λ*Q*λ*y*.**in'**(𝒟(λ*x*[*S* (**in'**(*x*)) & **place'**(*x*)]))*Q*(*y*) >. A derivation of *place (that) we stayed* is shown in (19), where it can be seen that the phrase has the conjunctive type N ∧ N-*bnpa*, as desired. The step labeled with an asterisk would be omitted if *that* did not appear. Also, the line labeled ∨I would be more specifically labeled ∨I*a* or ∨I*b*, depending on whether CP ∨ S is being derived from a CP or an S.

(19) Derivation of *place (that) we stayed*

place	*(that)*	*we*	*stayed*	1
(N ∧ N-*bnpa*)/	CP/S:	NP:	VP:	[VP\VP]:
((CP ∨ S)/(VP\VP)):	λ*X*.*X*	**we'**	**stay'**	α
λ*S*< λ*x*[*S* (**in'**(*x*)) & **place'**(*x*)],				\E
λ𝒟λ*Q*λ*y*.**in'**(𝒟(λ*x*[*S* (**in'**(*x*)) & **place'**(*x*)]))*Q*(*y*) >			VP: α **stay'**	\E
			S: α **stay'**(**we'**)	/E*
			CP: α **stay'**(**we'**)	∨I
			CP ∨ S: α **stay'**(**we'**)	/I1
			(CP ∨ S)/(VP\VP): λα.α**stay'**(**we'**)	/E

N ∧ N-*bnpa*: < λ*x*[**in'**(*x*)**stay'**(**we'**) & **place'**(*x*)],
λ𝒟λ*Q*λ*y*.**in'**(𝒟(λ*x*[*S* (**in'**(*x*)) & **place'**(*x*)]))*Q*(*y*) >

4.3.2 Nonadverbial relative clauses

The analog of rule (18) to allow for nonadverbial non-*wh* RCs as arguments to BNPA nouns would be as shown in (20):

(20) Nonadverbial RC addition lexical rule for BNPA nouns
N ∧ N-*bnpa*: $\alpha \Rightarrow$ (N ∧ N-*bnpa*)/((CP ∨ S)/NP):
$\lambda P<\lambda x[P(x) \,\&\, \pi 1\alpha(x)], \pi 2\alpha[\pi 1\alpha \rightarrow \lambda x[P(x) \,\&\, \pi 1\alpha(x)]]>$

Inputting *place* to rule (20), we would obtain the output $\lambda P<\lambda x[P(x)$ **& place'**$(x)]$, $\lambda \mathcal{D}\lambda Q\lambda y.$**in'**$(\mathcal{D}(\lambda x[P(x)$ **& place'**$(x)]))Q(y) >$. A derivation for *place (that) we found* is shown in (21). As with the derivation in the previous section, the step labeled with an asterisk would be omitted in the absence of *that*.

(21) Derivation of *place (that) we found*

place	*(that)*	*we* *found*		1
(N ∧ N-*bnpa*)/	CP/S:	NP:	VP/NP:	[NP]:
((CP ∨ S)/NP):	$\lambda X.X$	**we'**	**find'**	x
			/E	
$\lambda P<\lambda x[P(x)$ **& place'**$(x)]$,				
$\lambda \mathcal{D}\lambda Q\lambda y.$**in'**$(\mathcal{D}(\lambda x[P(x)$ **&**		VP: **find'**(x)		
place'$(x)]))Q(y) >$				\E
		S: **find'**(x)**(we')**		
				/E*
		CP: **find'**(x)**(we')**		
				∨I
		CP ∨ S: **find'**(x)**(we')**		
				/I1
		(CP ∨ S)/NP: $\lambda x.$**find'**(x)**(we')**		
				/E

N ∧ N-*bnpa*: $<\lambda x[$**find'**(x)**(we')** & **place'**$(x)]$,
$\lambda \mathcal{D}\lambda Q\lambda y.$**in'**$(\mathcal{D}(\lambda x[$**find'**$(x)$**(we')** & **place'**$(x)]))Q(y) >$

The corresponding lexical rule for ordinary nouns would be as follows:

(22) Nonadverbial RC addition lexical rule for ordinary nouns
N: $\alpha \Rightarrow$ N/((CP ∨ S)/NP): $\lambda P\lambda x[P(x) \,\&\, \alpha(x)]$

These two rules have not been written as a single rule because they take different input types. Still, since they do essentially the same thing, finding a way to combine them should be done in the interest of capturing a generalization. Another reason to combine these rules is that they may even generate spurious ambiguity with BNPA nouns. Consider the phrase *the place we found.* Rule (21) would be the appropriate one here, taking *place,* of category N ∧ N-*bnpa*, and returning something of category (N ∧ N-*bnpa*)/((CP ∨ S)/NP) to allow for the *we found* RC. However, if lexical rules are considered to be part of the rules of inference for a grammar (instead of simply expressing relations that hold among lexical items), then (22) could produce the same result as (21). Specifically, ∧E would take *place* from type N ∧ N-*bnpa* to N, and (22) could then operate.

I have already introduced the device that will allow us to combine rules (21) and (22): the variable ©. Using ©, the syntactic portion of the combined (21) and (23) would be:

(24) Nonadverbial RC addition lexical rule for all nouns (preliminary)
N© ⇒ N©/((CP ∨ S)/NP)

The question now is how to specify the semantic portion of this rule. First, my assumption of semantically semi-active type conjunction should be recalled. That is, given a word of category A ∧ B ∧ ... and meaning < π1α, π2α, ... >, there will be a shared core meaning in all the list elements. That core meaning will be π1α, which will appear as a subterm somewhere in π2α and each other element in the list. A rule can now be formulated for how lexical rules are to be interpreted when they take an argument with a conjunctive type.

(25) **Convention for lexical rules involving conjunctive types**
Given a lexical rule R that operates on words of type A ∧ B ∧ ... ,
and given a word of type A ∧ B, with meaning < π1α, π2α, ... >,
the input to R will be π1α; the output of R will be known as *r*(π1α);
and the meaning of the newly generated word will be
λ*x1*...λ*xn*< *r*(π1α), π2α[π1α → *r*(π1α)], ... >,
where *x1*...*xn* are any variables free in *r*(π1α).

With this convention stated, the nonadverbial RC addition rule with semantics included can now be written:

(26) Nonadverbial RC addition lexical rule for all nouns
N©: $\alpha \Rightarrow$ N©/((CP $\vee$ S)/NP): $\lambda x[P(x) \,\&\, \alpha(x)]$

With *place,* © will be $\wedge$ N-*bnpa*; the input will be $\pi 1\alpha$, **place'**, following the convention since *place* has a conjunctive type. $r(\pi 1\alpha)$ will then be $\lambda x[P(x) \,\&\, \mathbf{place'}(x)]$. Once the new variable, *P,* is abstracted, the semantics of the RC-taking version of *place* will then be (N $\wedge$ N-*bnpa*)/((CP $\vee$ S)/NP): $\lambda P<\lambda x[P(x) \,\&\, \mathbf{place'}(x)], \lambda \mathcal{Q}\lambda Q\lambda y[\mathbf{in'}(\mathcal{Q}(\lambda x[P(x) \,\&\, \mathbf{place'}(x)]))Q(y)]>$, the meaning seen in the earlier derivations.

This concludes my discussion of non-*wh* RCs, both nonadverbial and adverbial, for BNPA nouns and ordinary nouns. In the remaining parts of section 4, I will extend the analysis to infinitival RCs, and consider the lexical item *reason,* which acts like a BNPA noun with respect to RCs, but not otherwise.

4.4 Infinitival relative clauses

Infinitival RCs are particularly suited to the approach developed in the previous sections, since most infinitival RCs are not introduced by a relativizer (the exceptions being *wh*-RCs with pied piping, such as *topic about which to write*, about which I will have nothing to say). I will take the RC addition lexical rules of the previous section as the starting point for this one. Although the focus of this paper is BNPA nouns, it will be convenient to begin with the lexical rules for ordinary nouns, and then extend from there to the BNPA nouns. Starting with ordinary nouns entails starting with nonadverbial RCs, which is therefore the topic in section 4.4.1.

4.4.1 Nonadverbial infinitival relative clauses

Recall the nonadverbial RC addition lexical rule for ordinary nouns from section 4.4:

(27) Nonadverbial RC addition lexical rule for ordinary nouns
N: $\alpha \Rightarrow$ N/((CP $\vee$ S)/NP): $\lambda P\lambda x[P(x) \,\&\, \alpha(x)]$

For maximum generality, it would be nice if this rule could account for both infinitival and finite RCs as it is written. This, however, is not to be. If we consider *for* to be a complementizer, then, for example, *for Kim to read* would be a CP/NP, which would work. But then *Kim to read* would be an S/NP, and a phrase like **a book Kim to read* would be licensed. Therefore, the infinitival version of the above rule will be written as two rules:

(28) Nonadverbial infinitival RC addition lexical rules for ordinary nouns

a. With *for* complementizer

N: $\alpha \Rightarrow$ N/(CP*inf*/NP): $\lambda P\lambda x[P(x) \,\&\, \alpha(x)]$

b. Without *for* complementizer

N: $\alpha \Rightarrow$ N/(VP*inf*/NP): $\lambda R\lambda x[\exists y R(x)(y) \,\&\, \alpha(x)]$

Here I will assume that *for* is in fact a complementizer, with meaning $\lambda X.X$. I take *to* to be of category VP*inf*/VP, with meaning $\lambda P\lambda x[\Diamond P(x)]$. The $\Diamond$ is the modal operator for possibility, indicating that the action in an infinitive does not necessarily take place. The lexical entries are summarized in (29):

(29) *for* – CP*inf*/S*inf*: $\lambda X.X$

to – VP*inf*/VP: $\lambda P\lambda x[\Diamond P(x)]$

Derivations for *book for Kim to read* and *book to read* are shown in (30) and (31). For ease of readability, the *inf* subscripts are omitted from the categories.

(30) Derivation of *book for Kim to read*

book	*for*	*Kim*	*to*	*read*	1
N/(CP/NP):	CP/S:	NP:	VP/VP:	VP/NP:	NP:
$\lambda P\lambda x[P(x)$ & **book'**$(x)]$	$\lambda X.X$ **kim**	$\lambda P\lambda x[\Diamond P(x)]$	**read'**	y	
				/E	
			VP: **read'**(y)		
		/E			
		VP: $\lambda x[\Diamond$**read'**$(y)(x)]$			
		\E			
		S: $\Diamond$**read'**(y)(**kim**)			
	/E				
	CP: $\Diamond$**read'**(y)(**kim**)				
	/I1				
	CP/NP: : $\lambda z[\Diamond$**read'**(z)(**kim**)]				
/E					

N: $\lambda x[\Diamond$**read'**(x)(**kim**) & **book'**$(x)]$

(31) Derivation of *book to read*

book	*to*	*read*	1
N/(VP/NP):	VP/VP:	VP/NP:	NP:
$\lambda R\lambda x[\exists y R(x)(y)$	$\lambda P\lambda x[\Diamond P(x)]$	**read'**	y
& **book'** $(x)]$			D
	VP: $\lambda x[\Diamond$**read'**$(y)(x)]$		/I1
	VP/NP: $\lambda z\lambda x[\Diamond$**read'**$(z)(x)]$		/E

N: $\lambda x[\exists y \Diamond$**read'**$(x)(y)$ & **book'**$(x)]$

Moving on to BNPA nouns, the corresponding lexical rules would be:

(32) Nonadverbial infinitival RC addition lexical rule for BNPA nouns

a. With *for* complementizer

N $\wedge$ N-*bnpa*: $\alpha \Rightarrow$ (N $\wedge$ N-*bnpa*)/(CP*inf*/NP):

$\lambda P<\lambda x[P(x)$ & $\pi 1\alpha(x)]$, $\pi 2\alpha[\pi 1\alpha \rightarrow \lambda x[P(x)$ & $\pi 1\alpha(x)]]>$

b. Without *for* complementizer

N $\wedge$ N-*bnpa*: $\alpha \Rightarrow$ (N $\wedge$ N-*bnpa*)/(VP*inf*/NP):

$\lambda R<\lambda x[\exists y R(x)(y)$ & $\pi 1\alpha(x)]$,

$\pi 2\alpha[\pi 1\alpha \rightarrow \lambda x[\exists y R(x)(y)$ & $\pi 1\alpha(x)]]>$

Derivations for *place for Kim to find* and *place to find* will not be given, since they parallel the last two derivations.

4.4.2 Adverbial infinitival relative clauses

The appropriate modifications have been made to the nonadverbial infinitival RC addition lexical rules from the previous section, and are given in (33):

(33) Adverbial infinitival RC addition lexical rule for BNPA nouns

a. With *for* complementizer

N ∧ N-*bnpa*: <π1α, π2α> ⇒ (N ∧ N-*bnpa*)/(CP*infl*(VP\VP)):
λ*S*< λ*x*[*S* (**prep**(*x*)) & π1α(*x*)],
π2α[π1α→ λ*x*[*S* (**prep**(*x*)) & π1α(*x*)]] >
where π2α = λ𝒟λ*Q*λ*y*.**prep**(𝒟(π1α))*Q*(*y*)

b. Without *for* complementizer

N ∧ N-*bnpa*: <π1α, π2α> ⇒ (N ∧ N-*bnpa*)/(VP*infl*(VP\VP)):
λ*V*< λ*x*[∃*yV*(**prep**(*x*))(*y*) & π1α(*x*)],
π2α[π1α→ λ*x*[∃*yV*(**prep**(*x*))(*y*) & π1α(*x*)]] >
where π2α = λ𝒟λ*Q*λ*y*.**prep**(𝒟(π1α))*Q*(*y*)

Derivations for *place for Kim to stay* and *place to stay* follow:

(34) Derivation for *place for Kim to stay*

PART A:

for	*Kim*	*to*	*stay*	———1
CP*infl*/S*inf*:	NP:	VP*infl*/VP:	VP:	VP\VP:
λ*X*.*X*	**kim**	λ*P*λ*x*[◊*P*(*x*)]	**stay'**	α

———————\E
VP: α**stay'**
———————/E
VP*inf*: λ*x*[◊α**stay'**(*x*)]
———————\E
S*inf*: ◊α**stay'**(**kim**)
———————/E
CP*inf*: ◊α**stay'**(**kim**)
———————/I1
CP*infl*(VP\VP): λα[◊α**stay'**(**kim**)]

PART B:

place	*for Kim to stay*
(N ∧ N-*bnpa*)/(CP*infl*(VP\VP)):	CP*infl*(VP\VP):
λ*S*< λ*x*[*S*(**in'**(*x*)) & **place'**(*x*)],	λα[◊α**stay'**(**kim**)]
λ𝒟λ*Q*λ*y*.**in'**(𝒟(λ*x*[*S*(**in'**(*x*)) & **place'**(*x*)]))*Q*(*y*)] >	

———————————————————————————/E

N ∧ N-*bnpa*: < λ*x*[◊**in'**(*x*)**stay'**(**kim**) & **place'**(*x*)],
λ𝒟λ*Q*λ*y*.**in'**(𝒟(λ*x*[◊**in'**(*x*)**stay'**(**kim**) & **place'**(*x*)]))*Q*(*y*) >

(35) Derivation for *place to stay*

place	*to stay*
(N ∧ N-*bnpa*)/(VP*infl*(VP\VP)):	VP*infl*(VP\VP):
$\lambda V<\lambda x[\exists y V(\mathbf{in'}(x))(y)$ & **place'**$(x)]$,	$\lambda\alpha\lambda x[\Diamond\alpha$**stay'**$(x)]$
$\lambda\mathcal{Z}\lambda\mathcal{Q}\lambda y.$**in'**$(\mathcal{Z}(\lambda x[\exists y V(\mathbf{in'}(x))(y)$ & **place'**$(x)]))\mathcal{Q}(y)>$	

/E

N ∧ N-*bnpa*: $<\lambda x[\exists w[\Diamond$**in'**$(x)$**stay'**$(w)]$ & **place'**$(x)]$,
$\lambda\mathcal{Z}\lambda\mathcal{Q}\lambda y.$**in'**$(\mathcal{Z}(\lambda x[\exists w[\Diamond$**in'**$(x)$**stay'**$(w)]$ & **place'**$(x)]))\mathcal{Q}(y)]>$

4.5 Overview of lexical rules

By now, I have accumulated a fair number of lexical rules concerning BNPA nouns, as well as corresponding versions for ordinary nouns where appropriate. The aim here will be to survey them and combine them where possible. The lexical rules that have been introduced are summarized in (36), giving only the titles and syntactic portions:

(36) a. Nonadverbial RC addition for all nouns
N© ⇒ N©/((CP*fin* ∨ S*fin*)/NP)

b. Nonadverbial infinitival RC addition for all nouns (with *for*)
N© ⇒ N©/(CP*inf*/NP)

c. Nonadverbial infinitival RC addition for all nouns (without *for*)
N© ⇒ N©/(VP*inf*/NP)

d. Adverbial RC addition for BNPA nouns
N ∧ N-*bnpa* ⇒ (N ∧ N-*bnpa*)/((CP*fin* ∨ S*fin*)/(VP\VP))

e. Adverbial infinitival RC addition for BNPA nouns (with *for*)
N ∧ N-*bnpa* ⇒ (N ∧ N-*bnpa*)/(CP*inf*/(VP\VP))

f. Adverbial infinitival RC addition for BNPA nouns (without *for*)
N ∧ N-*bnpa* ⇒ (N ∧ N-*bnpa*)/(VP*inf*/(VP\VP))

The rules have already been compacted to some degree by means of the © variable. We can compact them further by collapsing some of the rules for finite RCs with those for infinitival RCs. Consider (36.a, b, c). As was noted in section 4.4.1, these three rules cannot be completely integrated, but we can certainly capture in one rule the fact that a CP, whether finite or infinitival, is acceptable, by leaving it unspecified, and thus collapse (36.a) and (36.b); likewise (36.d) and (36.e), as shown in (37):

(37) a/b. Nonadverbial RC addition for all nouns
N© ⇒ N©/((CP ∨ S*fin*)/NP)
d/e. Adverbial RC addition for BNPA nouns
N ∧ N-*bnpa* ⇒ (N ∧ N-*bnpa*)/((CP ∨ S*fin*)/(VP\VP))

4.6 The case of *reason*

As mentioned earlier, the set of BNPA nouns and the set of nouns that can head non-*wh* adverbial RCs without preposition stranding are not entirely the same. The data in (4), rewritten below as (38), show *reason* is in the latter set, but not the former. *Spot* is an even more specialized case: it can head infinitival adverbial relatives, as in (38.c), but not finite ones, such as **the spot that we sat.*

(38) a. the {reason, *cause) (that) Kim fired Robin
b. Kim fired Robin *(for) this reason.
c. a shady (spot, place, *area) to sit
d. Kim sat *(in) that spot.

For unique cases like these, the solution is simply to assign the appropriate category and semantics directly. There is no need for the kind of lexical rule seen in the previous sections, since it is not a whole class of words that exhibits this pattern. The lexical entry for *reason* would have to be N ∧ N/((CP ∨ S*fin*)/(VP\VP)) ∧ N/(VP*inf*/(VP\VP)), which will allow for *the reason (that) Kim fired Robin*, and also *reason for Kim to fire Robin,* and *reason to fire Robin.* The category can be written more compactly as N ∧ N/((CP ∨ S*fin* ∨ VP*inf*)/(VP\VP)). For *spot,* we would want N ∧ N/((CP*inf* ∨ VP*inf*)/(VP\VP)), to allow for *a spot (for Kim) to sit.* Neither word is eligible to undergo the lexical rules for BNPA nouns, since neither is of category N ∧ N-*bnpa*; both rules are still free to undergo the lexical rules for ordinary nouns, since they are both instances of N ∧ N©.

5 Possible problems

5.1 The coordination problem

In all the preceding derivations, the type N ∧ N-*bnpa* undergoes ∧E prior to the word's incorporation into a larger block, but there is nothing that requires this to happen. If a verb took an argument that was simultaneously both N and N-*bnpa*, then a phrase of type N ∧ N-*bnpa* would fill the bill without eliminating either of the type conjuncts. Thus,

phrases such as *like and live every place* would be licensed (brought to my attention by Vaillette, p.c.). (Indeed, Johnson and Bayer (1995) take advantage of this fact in developing their analysis of a similar coordination in German, where an NP needs to be both dative and accusative at once to combine with a conjoined verb.) Also derivable are RCs which contain conjoined VPs and are nonadverbial when one VP conjunct is considered, but adverbial for the other, as in *a place (that) I liked and lived.* If these examples are ungrammatical, then the BNPA analysis here has a problem.

Until recently, I did not question the ungrammaticality of such examples, but the following attestation of a nonadverbial/adverbial RC raises questions about such an assumption:

(39) "He decided to remain because it was a place he loved and felt comfortable." (Rich Warren, "Ghost stories: an old friend drops in for a séance," *Columbus Alive*, 4 Nov. 1999, p. 10.)

If (39) is good for some people, perhaps *like and live every* place would be as well. On the one hand, existence of (39) is a nice confirmation of a prediction made by the BNPA analysis here; on the other hand, there is still the question of how to rule out such examples for people who do find them ungrammatical.

Finally, it should be noted that the coordination problem is not unique to analyses that make use of conjoined type structures. Similar problematic coordinations have been noted before; here are a few compiled from other sources by Carpenter (1997):

(40) (from Carpenter (1997), p. 196)
a. *The student [who likes] and [in] the library was studying.
b. ?[I bought every red] and [Jo liked some blue] t-shirt.
c. ?[The man who buys] and [the woman who sells] rattlesnakes met outside.
d. *I saw [a friend of] and [the manufacturer of] Dana's handbag.
e. *Sue saw the man [through the telescope] and [with the troublesome kid].

Consider, for example, (40.b). In it, two S/Ns are being coordinated. There is no conjoined type at all here. The rules for coordination, it seems, need to be finer-grained. It is not enough for the coordinated items to have the same type; they must be alike in other ways as well. For instance, there seems to be some kind of parallelism constraint at

work that rules out coordinations like **the trips from Boston to New York by train and from LA by plane.* The coordination is good only if the *from, to,* and *by* PPs in the first conjunct are mirrored in the second, as in *the trips from Boston to New York by train and from New York to LA.* Examples like this one were pointed out to me by Dowty (p.c.), who speculates that when the features for the various types are specific enough, then coordination will, after all, be as simple as taking two elements of type Y to yield an element of type Y, with the requirement that all (or some subset of) the feature values of Y match up. Such a theory is beyond the scope of this paper, but has been mentioned just to show that problems like those mentioned need not be terminal for conjunctive types, and in particular for the conjunctive-type analysis of BNPA nouns.

5.2 Other questions to resolve

In addition to the coordination problem, there are a few other issues that were not discussed here. One is covering the facts for scoping phenomena; presently, all quantified BNPAs must take narrow scope. Restrictive *wh-* RCs are another question: I used McCawley's argument in favor of all restrictive RCs being complements to bolster our case for the complementhood of just non-*wh* RCs. As to the status of restrictive *wh-* RCs, I make no claim.

Two other BNPA-related issues have not been mentioned here, but are discussed in Whitman (1998). The first concerns determiners. All the examples with determiners presented here have used *every* with the idea that the same approach could be used with any determiner. However, not all determiners are equally good with BNPA nouns. For example, *the* is usually bad; consider **We stayed the place, *We did it the way,* etc. It is tempting to say that what determiners are allowed is a pragmatic matter when examples like those mentioned and **We did it a way* are considered, but one conclusion Whitman draws is that pragmatics alone will not explain all the data. The other issue concerns prepositions. Although BNPA nouns have been assumed to be able to function as ordinary nouns, there are some cases where an ordinary noun can be modified by an RC with a stranded preposition, while a BNPA noun cannot. To illustrate, consider first *a place to eat.* This is grammatical by virtue of the N-*bnpa* part of the type for *place,* but *a place to eat at* is also good, since *place* is after all, an N as well as an N-*bnpa.* But with temporal BNPA nouns, the preposition is not so acceptable: *?the day the music died on.* And for manner BNPA nouns, it is definitely bad: **the way they did it in.* For a detailed discussion of both issues, the reader is referred to Whitman (1998).

5 Conclusion

I have presented an analysis of BNPA nouns that accounts for their two characteristic properties: the ability to form adverb phrases without use of prepositions, and the ability to head non-*wh* adverbial RCs without preposition stranding. The core of the analysis is the use of a conjunctive category, N ∧ Det\(VP\VP), abbreviated as N ∧ N-*bnpa*, with a variable, ©, introduced to allow for modification of words and phrases with conjunctive categories. This variable not only allows for modification of BNPA nouns, but also provides a rough type-logical equivalent of Kasper's HPSG system for recursive modification. The account for non-*wh* adverbial RCs leads to a unified account of all non-*wh* RCs (adverbial and nonadverbial, both finite and infinitival, for BNPA nouns and for ordinary nouns alike), in addition to collapsing the definitions of relativizer and complementizer *that*. Thus, aside from capturing the relevant facts about BNPAs, the analysis here enjoys a measure of independent motivation.

Appendix

Proving that N\N \⇒ ((NP/N)\(VP\VP))\((NP/N)\(VP\VP))

Start

Two possibilities: [1], [2]

N\N ⇒ ((NP/N)\(VP\VP))\((NP/N)\(VP\VP))

Possibility [1]

Three possibilities: [1.1], [1.2.1], [1.2.2]

(NP/N)\(VP\VP), N\N ⇒ (NP/N)\(VP\VP)

---\R

N\N ⇒ ((NP/N)\(VP\VP))\((NP/N)\(VP\VP))

Possibility [1.1]

Four possibilities: [1.1.1], [1.1.2.1], [1.1.2.2], [1.1.2.3]

NP/N, (NP/N)\(VP\VP), N\N ⇒ VP\VP

---\R

(NP/N)\(VP\VP), N\N ⇒ **(NP/N)\(VP\VP)**

Possibility [1.1.1]

Three possibilities: [1.1.1.1], [1.1.1.2], [1.1.1.3]

VP, NP/N, (NP/N)\(VP\VP), N\N ⇒ VP

---\R

NP/N, (NP/N)\(VP\VP), N\N ⇒ **VP\VP**

Possibility [1.1.1.1]

$$\dfrac{(NP/N)\backslash(VP\backslash VP),\ N\backslash N \Rightarrow N \quad \overset{\textbf{fail}}{\overbrace{VP,\ NP \Rightarrow VP}}}{VP,\ \mathbf{NP/N},\ (NP/N)\backslash(VP\backslash VP),\ N\backslash N \Rightarrow VP}\ /L$$

Possibility [1.1.1.2]

$$\dfrac{VP,\ NP/N \Rightarrow NP/N \qquad \overset{\textbf{fail}}{\overbrace{VP\backslash VP,\ N\backslash N \Rightarrow VP}}}{VP,\ NP/N,\ \mathbf{(NP/N)\backslash(VP\backslash VP)},\ N\backslash N \Rightarrow VP}\ \backslash L$$

Possibility [1.1.1.3]

$$\dfrac{VP,\ NP/N,\ (NP/N)\backslash(VP\backslash VP) \Rightarrow N \qquad \overset{\textbf{fail}}{\overbrace{N \Rightarrow VP}}}{VP,\ NP/N,\ (NP/N)\backslash(VP\backslash VP),\ \mathbf{N\backslash N} \Rightarrow VP}\ \backslash L$$

Possibility [1.1.2.1]

$$\dfrac{\dfrac{\overset{\textbf{fail}}{\overbrace{\Rightarrow NP/N}} \qquad \overset{\textbf{fail}}{\overbrace{VP\backslash VP \Rightarrow N}}}{(NP/N)\backslash(VP\backslash VP) \Rightarrow N}\ \backslash L \qquad NP,\ N\backslash N \Rightarrow VP\backslash VP}{\mathbf{NP/N},\ (NP/N)\backslash(VP\backslash VP),\ N\backslash N \Rightarrow VP\backslash VP}\ /L$$

Possibility [1.1.2.2]

$$\dfrac{\dfrac{}{\text{NP/N} \Rightarrow \text{NP/N}}\text{Ax} \qquad \dfrac{}{\textbf{fail}}}{\text{NP/N, } \textbf{(NP/N)\(VP\VP)}\text{, N\N} \Rightarrow \text{VP\VP}}\backslash\text{L}$$

Possibility [1.1.2.3]

$$\dfrac{\dfrac{\dfrac{}{\textbf{fail}} \qquad \dfrac{}{\textbf{fail}}}{\Rightarrow \text{NP/N} \qquad \text{VP\VP} \Rightarrow \text{N}}\backslash\text{L} \qquad \text{NP/N, N} \Rightarrow \text{VP\VP}}{\text{NP/N, (NP/N)\(VP\VP), } \textbf{N\N} \Rightarrow \text{VP\VP}}\backslash\text{L}$$

Possibility [1.2.1]

$$\dfrac{\dfrac{}{\textbf{fail}}}{\Rightarrow \text{NP/N} \qquad \text{(VP\VP), N\N} \Rightarrow \text{(NP/N)\(VP\VP)}}\backslash\text{L}$$

$$\textbf{(NP/N)\(VP\VP)}\text{, N\N} \Rightarrow \text{(NP/N)\(VP\VP)}$$

Possibility [1.2.2]

$$\dfrac{\dfrac{\dfrac{}{\textbf{fail}}}{\Rightarrow \text{NP/N} \qquad \text{VP\VP} \Rightarrow \text{N}}\backslash\text{L} \qquad \text{N} \Rightarrow \text{(NP/N)\(VP\VP)}}{\text{(NP/N)\(VP\VP), } \textbf{N\N} \Rightarrow \text{(NP/N)\(VP\VP)}}\backslash\text{L}$$

Possibility [2]

fail	**fail**	
$\Rightarrow$ N	N $\Rightarrow$ ((NP/N)\(VP\VP))\((NP/N)\(VP\VP))	
N\N $\Rightarrow$ ((NP/N)\(VP\VP))\((NP/N)\(VP\VP))		\L

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